A Compleat

DISCOURSE

OF THE

Nature, Use, and Right Managing

Of that Wonderful

INSTRUMENT,

THE

BAROSCOPE,

OR

Quick-Silver Weather-Glass.

In IV. PARTS.

By *JOHN SMITH*, C.M.

To which is added, The true Equation of Natural Days; drawn up for the use of the Gentry, in order to their more true Adjusting, and Right Managing of Pendulum Clocks and Watches.

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To the READER,

Giving an Account of the First Original of this Instrument.

THIS *Nobe Instrument, the Baroscope, which the Reverend and Learned Dr.* **John Beale** *thinks to be the most wonderful that ever was found out in the World, does owe its first Rise and Original to an Experiment first made by the Famous* **Torricelius**, *an Italian Mathematicion, who in order to the making of some new Discoveries in the Mysteries of Nature, took a Glass Tube about three Foot long, and having sealed it hermetically at one End, he filled it at the*

Phylos. Trans. N. 9. p. 155.

the other with pure Quick-Silver, and emerſing the open End of it into another Veſſel of Mercury, he found that the Quick-Silver, which before filled the whole Tube, did now in part ſink down into the lower Veſſel, leaving in the upper part of the Glaſs-Pipe, a ſeeming void and empty ſpace. Which rare and unuſual appearance did ingage him to a more particular notice of it, and induce him to repeat the Experiment: Which being done in Tubes of divers Lengths and different Bores, he ſtill found that the Mercury ſunk down in each of them to near the ſame pitch, as in the firſt Experiment, which was to about the height of 29 or 30 Inches, except in Tubes that were ſhorter than this Meaſure, in which caſe, they always remained full.

Which

Which Experiment being ſoon noiſed abroad, it put others as well as this firſt Inventer, upon the enquiry what the true Cauſe was, that the Mercury ſhould thus fall down to ſuch a pitch and no lower; as likewiſe whether or no that ſeemingly void Space in the upper part of the Tube were indeed empty, as it did ſeem to be, ſince according to an old Maxim in Philoſophy, There could be no Vacuity in Nature.

But while theſe Particulars were under Examination, it was obſerv'd by ſome, That the Mercury in the ſame Tube did not always keep the ſame ſtation, but was ſometimes riſen higher than uſual, and at other times fallen down more low, which at length was judged to proceed from no other cauſe but the differing weight of that Air, whoſe ponderoſity

ſity was already ſuppoſed to be the true cauſe of the Mercurys being ſo ſuſpended, as in the firſt Experiment: And theſe Changes in the Height of the Mercurial Cylinder, being in proceſs of time obſerved, for the moſt part, to happen alſo in the ſame Changes of Air, it being always Higheſt in Fair Seaſons, and Loweſt in Foul, it was at laſt propoſed as a very fit Inſtrument to aſſiſt us in Preſaging the Future State and Change of Weather.

Note, That the Honourabe Rob. Boyle, *Eſq; as Dr* Beale *tells us, in* Phil. Tranſ. *N. 9. p. 153, was the firſt that ever diſcovered this Uſeful Inſtrument to the Engliſh Nation, and therefore does deſerve from us all due Acknowledgments for thoſe Beneſits which we either have or may hereafter receive by it.*

A Compleat

TREATISE

OF THE

BAROSCOPE, &c.

The INTRODUCTION.

BAroſcopes have heretofore been made up after divers manners, but chiefly three ways: As firſt, That now commonly uſed, with a Streight Tube, aſcribed chiefly to the Noble *Boyle*. Secondly, That with a Tube, whoſe Top inclines, deviſed by Sir *Samuel Morland*. Thirdly,

ly, The Wheel-Baroſcope, invented by the Ingenious Mr. *Robert Hook* (and deſcribed in his Micography) but of theſe three ſorts, the two laſt are but ſeldom uſed, by reaſon of ſome Inconveniencies either in the Shape or Charge; Sir *Samuel*'s being ſuch as will not admit of any Regular Figure, and Mr. *Hooks* being very Dear and Coſtly. 'Tis true, theſe do both of them manifeſt the leaſt Motions of the Mercury more viſibly than that with the Sreight Tube, eſpecially the Latter; but this is found to be no great Advantage, in regard that ſuch nice Motions are but ſeldom followed with any conſiderable Alteration in the State of

of Weather : But for thoſe Motions of the Mercury, as are indeed true Tokens of any great Change, to Wet or Dry, theſe are ſufficiently manifeſt in the Common Baroſcope, or that with the Streight Tube; which being alſo moſt Regular, of ſmalleſt Price, and moſt eaſie to be made and managed, ſhall therefore be the Subject of the following Diſcourſe.

PART I.

Of the ſeveral Parts of the Common Baroſcope, and the moſt Convenient and Proper Dimenſions that are to be obſerved in making of it up.

THE Baroſcope or Quick-Silver-Weather-Glaſs is compoſed and made up of the following Parts.

Firſt, The Frame, or main Body of the Inſtrument. Secondly, A Glaſs-Tube or Pipe. Thirdly, A Ciſtern or Receiver. Fourthly, Two Regiſter-Plates, with a Sliding-Index.

Index. And Laſtly, A ſufficient Quantity of Quick-Silver to fill the Tube, and adjuſt the Receiver. Of theſe I ſhall treat in their order.

Of the Frame.

The Frame is Wood, of which any ſort may ſerve, but for Ornament ſake, the Choiceſt are generally made uſe of, ſuch as Ebony, Walnut or Olive-Wood. The Shape and Figure is various, according to the different Fancies of them that do either make or uſe them; but for the Size, that muſt always be ſuch, as that the Length may admit a Glaſs-Tube, of at leaſt three Foot Long, and its

Bredth ſufficient to affix thereon the Regiſter-Plates.

In the middle of this Frame muſt be cut out a half-round Grove or Channel, throughout the whole Length of it, and of ſuch a Depth, as may be ſufficient to ſecure the Tube, when ſet in it, from being Broken by any outward Accident; for which Reaſon this Grove ought always to be made ſo Deep, that the Tube may rather ſtand within, than any ways without the Wood of the Frame, for by this means it will be the better Secured from Danger. But ſome, to ſecure the Tube more effectually, add a Cover of Wood, which does effectually prevent thoſe Dangers, to which the

Glaſs

Glaſs is at any time ſubject.

Near the Bottom of the Frame is to be affixed the Ciſtern-Box and Cover of ſuch a Size and Bigneſs as may admit a Glaſs Ciſtern of three Inches Diameter, or three and a half, and one Inch in Height, at leaſt.

Laſtly, Upon the upper part of the Frame are to be affixed the two Regiſter-Plates. in doing of which you muſt obſerve a due Diſtance between the Loweſt Diviſion on the Regiſters, and the Bottom of the Ciſtern-Box; and for this the Rule is, To ſet the one juſt 28 Inches and a half diſtant from the other. I know ſome are not willing to

admit above 28, and a quarter Diſtance, becauſe leſs Mercury will then ſerve to adjuſt the Receiver; but this is too little in Reaſon. We think it moſt requiſite to allow a quarter of an Inch more, (ſome allow more than this) that ſo there may be a greater Depth of Quick-Silver to immerge the open-End of the Tube in, for the Deeper this open-End of the Glaſs is buried in the Quick-Silver, the better will the Air be prevented from any ways getting into the Bore of the Tube, which in the long ſtanding of ſome Tubes, whoſe open-End has been but ſlightly buried in the Mercury, it has been found to do; for Air is ſo ſubtle a Matter,

Matter, that it will be apt to inſinuate it ſelf by degrees into the Tube, in ſpite of all the Quick-Silver within it, unleſs there be a ſufficient quantity without, to prevent its depreſſing it ſelf ſo low as to get in at the open-End: And tho' our Senſes perhaps cannot perceive this, yet the Glaſs it ſelf will diſcover it at laſt, who in a few Years ſtanding will not move ſo Regular as at firſt, by reaſon of the expanding and contracting of that Air that has thus inſenſibly got up into the Head of the Tube.

Of the Tube.

The Tube is a ſtrong, even-

blown

blown Pipe of clear Glaſs three Foot Long at the leaſt, and the Bore of it not leſs than two Tenths of an Inch, nor greater than one quarter of an Inch at moſt in Diameter; let it be ſealed very cloſe at one End with the Hermetick Seal, and filed very true and even at the other, yet ſomewhat aſloop.

Note, That if theſe Circumſtances are not all obſerved in it, the following Inconveniencies will certainly enſue.

For Firſt, The Bore muſt not exceed one quarter of an Inch; for if the Bore be larger, it will cauſe the Mercury in the Ciſtern to Riſe and Fall too much, when that in the Tube does on the contrary either

either Fall or Riſe (except due proportion be obſerved). And on the other hand, if the Bore be ſmaller than two tenths, it will then be extreme difficult to fill it with Mercury, and more difficult to purge it from Air when you have done ſo.

Secondly, Unleſs the Tube be well ſealed at the cloſed End, the Mercury will never be kept ſuſpended, but will ſtill ſink down into the Receiver, when ever you attempt to ſet it up for uſe. Now to know whether the ſealed End be perfectly cloſed up or no, do thus immerge or dip the ſealed End into a Veſſel of Water, and then blow ſtrongly at the other End with your

your Mouth, and if the Tube be not perfectly closed, you will perceive Bubbles to rise up through the Water, which Bubbles will not be found if the Sealing be firm.

Thirdly, Unless the open-End of the Tube be filed or ground very smooth and even, after it is first fitted to a Length, it will be very difficult, when filled with Quick-Silver, to put it up in the Frame it is to stand in, without the loss of much Mercury; for if the Tube have the least Gap or unevenness left in it, it will be very difficult to stop it so close with your Finger as to keep the Mercury from spurting out thence, when the Tube is filled

led, in order to be ſet up, for Quick-Silver of it ſelf is of ſo ſtrangly a fluid Nature, that when it is ſo preſt with its own weight, as it is in a full Tube, when thus elevated upright, in order to be ſet up, that it will make its way out at the leaſt Cranney imaginable.

But though it requires to be thus even and ſmooth at the End of the Tube; yet this ought to be ſo ordered, that the End be not perfect flat, but rather ſomewhat aſloop, that ſo when the Tube is ſet up in the Ciſtern, ſome part of its Edge may riſe from the Bottom, and not touch it on every part; by which means the Mercury will have the freer

liberty

liberty to paſs in and out, as it does riſe and fall in the Tube above.

Note, That in cutting a Glaſs-Tube to a due length, there is way to do it with eaſe and ſpeed, and that is by firſt filing a ſmall Notch in one Side of the Tube, and then laying that Notch over the Edge of ſome Iron, you may by ſtriking a little diſtance from it with a Hammer, on that part to be broak off, break it with eaſe: Which method is ſo certain and ſafe, that by it I have broken a piece of a Tube, a foot long into twenty ſeveral bits, without ever miſſing. This being a Novelty of ſome uſe, I thought fit to inſert it here.

Of the Ciſtern or Receiver.

The Ciſtern is a round Veſſel of Glaſs, about three quarters of an Inch deep, and three Inches in Diameter, at leaſt, or three and a half, and perfect flat at bottom. I know there be few yet made of this Size, neither will people be willingly perſwaded to admit of this bigniſs, in regard that it requires much Quick-ſilver to fill it its due depth, which being a dear Commodity, Men ſtrive rather to make as little ſerve as they can, that ſo the whole Inſtrument may be afforded more cheap by them that ſell them.

But

But for ſuch perſons as mind more the perfection of a Weather-Glaſs than the cheapneſs of its price; ſuch muſt be no-wiſe unwilling to admit of this magnitude, for in this one particular does the whole Perfection of the Baroſcope conſiſt, for the larger the Ciſtern is in Diameter, the more certainly may the Glaſs be adjuſted at all times, and the more exactly will the Mercury in the Tube both riſe and fall. And this I ſhall endeavour to make plain in both particulars.

Firſt, As to the true adjuſting of a Glaſs at all times, the more certainly, by means of a large Ciſtern: This I think will appear, by ſhewing the

the uncertainty of performing this, when the Ciſtern is ſmall; For, ſuppoſe a Glaſs be ſet up, and adjuſted, at a time when the Air is of ſo ſmall a weight, as to ſuſpend the Mercury no higher than 28 Inches and ½; and this ſame Glaſs were after a while to be taken down, and new ſet up, at ſuch a time when the Air is ſo weighty, as to buoy up the Mercury to 30 Inches and ½ high; I ſay then, That this Glaſs, which before was well adjuſted, when the Air was light, ſhall now, when the Air is thus much heavier, require ſo much more Quick-Silver to adjuſt it, as is contained in the Tube between the Figures of 28 ½, and 30 ½, for

ſo much Quick-Silver being now forced up into the Tube, will ſink that in a ſmall Ciſtern very conſiderably, and ſo much as is forc'd out of the Ciſtern into the Tube, ſo much muſt be added to the Ciſtern to make that Mercury in it riſe up, till it be within its due Diſtance of the Regiſter-Plate. Now it follows, That if more Quick-Silver be required to adjuſt a Weather-Glaſs, when the Air is heavy, than there does when the Air is light; then thoſe Glaſſes that have ſuch ſmall Ciſterns, cannot be good, for in a good Glaſs the ſame Quantity of Mercury that does once adjuſt it, will be ſufficient to adjuſt it at any time after; for in a

good

good Baroſcope, let the Air be Heavy or Light, or the Quick-Silver High or Low in the Tube, yet the ſurface of the Mercury in the Ciſtern ought always to keep the ſame Diſtance in Inches from any of the Figures on the Regiſter-Plate, as the number of the ſame Figure does import: Now if it muſt neither Riſe nor Fall in the Ciſtern, it follows, That the Ciſtern muſt be always ſo proportional to the Tube, that the greateſt Riſing and Falling above, muſt not any whit alter the ſurface of that below.

Secondly, As to the more exact Riſing and Falling in thoſe Tubes that ſtand in large Ciſterns, beyond thoſe that

ſtand in ſmall ones. I think this may be plainly underſtood, by conſidering the Motion of a Glaſs, at ſuch a time as the Air by becoming more Light, would naturally ſuffer the Mercury to ſink down in the Tube one whole Inch: In which caſe, ſuppoſe for demonſtration ſake, That a Ciſtern were ſo very ſmall, that this Inch Falling of the Mercury in the Tube, ſhall raiſe that of the Ciſtern, in which it ſtands, one compleat quarter of an Inch: From hence it will then follow, That when the Quick-Silver ſhould naturally have fallen in the Tube one whole Inch, yet it will not now appear to fall above three quarters, for falling

falling about three quarters above, and riſing almoſt a quarter below, will make the two Mercurial Surfaces to be now but 29 Inches aſunder, that before, we ſuppos'd, were 30, which is equivalent to the falling of an Inch of Mercury: Whereas, had the Ciſtern been ſo large as not to admit of any riſing, there then, the ſame Mercury in the Tube, muſt have fallen one whole Inch, before the two Mercurial Surfaces had been altered an Inch in Diſtance; from all which, it is plain, That one Glaſs with a ſmall Ciſtern, may fall but three quarters of an Inch, when another with a very large one, ſhall at the very ſame time fall a whole Inch.

And this ſhall ſuffice to demonſtrate the Neceſſity of the one, and the Uncertainty of the other, and what Care there ought to be taken, ſo to Proportion the Tube and Ciſtern, That the greateſt Riſing and Falling Above, ſhall not at all alter the Mercurial Surface Within the Receiver.

Now that you may Fit any Tube with a Ciſtern in this Proportion, do thus: Firſt, Make a Ciſtern-Gage, which need only be a Pin driven into the ſtreight Edge of a Ruler, and then cut off to ſuch a Length, That when the Ruler is laid croſs the Brims of the Ciſtern, the Pin may reach down to near the Middle of its Depth, or ſo Deep as you

you Judge the Mercury will Riſe when the Inſtrument is juſted.

Then take the Tube you intend for uſe (being firſt fitted to the Frame), and empty, as it is, put it up in its place, and with a Penſil make two Marks upon it, juſt againſt the Diviſions of 28 and 31, on the Regiſter; then take the Tube from the Frame, and fill it with Quickſilver quite full, ſtop it in with your Finger, and turn the Sealed End upright, and when you have ſo done, let down the Open End, ſo ſtopt, into a deep Earthen-Veſſel, and there let the Mercury run out gently till it be ſunk down in the Tube ſo low as the firſt or uppermoſt

Mark made thereon; at which making a ſtop, let the Mercury included between theſe two aforeſaid Marks, run out into another Veſſel by it ſelf, and when it is ſunk down to the loweſt Mark, make a ſtop, and let the reſt run out into the firſt Veſſel, or diſpoſe of it otherwiſe, at your own pleaſure.

Then let that Mercury contained between the two Marks aforeſaid, which was let run out into a Veſſel by it ſelf, be weighed exactly, and let the Weight be ſet down in a Paper, that ſo you may know again how to make out the ſame quantity on occaſion, or you may let that Matter remain in the oppoſite Scale, that did

did there counterpoiſe the Mercury ſo weighed.

When you have ſo done, then lay the Gage acroſs the Brims of the Ciſtern, and fill the Ciſtern with Mercury, till it juſt touch the Top of the Pin, then put in alſo, all that Mercury, which before was weighed; or ſo much as equivalent to the Weight of it ſet down or reſerved in the Scale; and if it does not raiſe the Surface of that Mercury, already in the Ciſtern, any whit ſenſibly, then is the Receiver fit for a Tube of that bigneſs, in regard that its Size is ſo large, that the whole Quantity of Mercury contained in the Tube, between theſe two Marks, anſwerable to its

higheſt Riſing and loweſt Falling, (when put in) does not any whit ſenſibly mount the Surface of that Mercury within it ſelf.

But if you find, by the help of the aforeſaid Gage, that this quantity of Quick-Silver, when put in, does raiſe the Ciſtern Mercury any whit ſenſibly above the Point of the Gage-Pin; then according to the former Method, try a Ciſtern ſomewhat bigger, and if that does not fit, then try a third, and continue ſo to do, till you have found out one whoſe Size is ſufficient for the Tube you intend to uſe.

He that obſerves this Rule, may exactly fit a Ciſtern to any Tube, and make it Proportional,

portional, let it be of what Size or Shape ſoever it will.

Note, That according to the foregoing Rule, a Tube whoſe Bore is two Tenths of an Inch in Diameter, will require a Ciſtern of three Inches over: And a Tube of a quarter of an Inch Bore will require one of three Inches and a half at leaſt. By which you may perceive how defective moſt Baroſcopes, already made, are in this point of Perfection.

Of the Regiſter-Plates and Sliding-Index.

The Regiſters (ſo called, becauſe they continually give an account of the Height of the Mercurial Cylinder) are two

two Braſs Plates of about ſix Inches in Length, and an Inch and a quarter broad; in the middle part of which, on that Edge that reſpects the Tube, are graduated, the diviſions of three whole Inches, with Decimal ſubdiviſions, and at the four Maſter-Lines, that bound theſe three Inch-Spaces are ingraven on one of the Plates the Figures following, *viz.* at the Lowermoſt 28, at the next 29, at the next to that 30, and at the Uppermoſt of all 31. Now the uſe of theſe Diviſions thus numbered, Is to ſhew how high, or how many Inches the Quick-Silver in the Tube does at any time ſurmount that Mercury in the Ciſtern below it.

In

In this firſt Regiſter-Plate is alſo cut out a Grove or Slit, ſomewhat longer than the Graduations, in which is to be fitted a Sliding-Index, whoſe uſe is to denote, both whether and how much, the Mercury does either Riſe or Fall within the Tube.

The other Regiſter-Plate is alſo divided and ſubdivided, as the former; yet not numbered with Figures as the other is, but inſtead thereof, there is ingraven thereon certain Words, which are deſigned to denote thoſe uſual States of Weather, which Learned and Ingenious Men have obſerved for the moſt part, to follow when the Mercurial-Cylinder is in Height equal to any

any of thoſe particular Diviſions to which thoſe Words are are affixed; the Words themſelves being theſe that follow, *viz.* at 28 is ingraven *Great Storms*, at 28 $\frac{1}{2}$, *Much Rain*, at 29, *Rain*, at 29 $\frac{1}{2}$, *Uncertain or Changeable*, at 30, *Fair*, at 30 $\frac{1}{2}$, *Setled Fair*, at 31, *Very dry*.

Of the Mercury, with which the Glaſs is filled.

As for the quantity of Quick-Silver, which each Baroſcope does require, no certain account can be given of that, in regard of the various Sizes of both Tubes and Ciſterns; in which reſpect ſeveral Quantities may be required. A good Baroſcope may

may take up from two Pound, to three or four Pound of Quick-Silver, according as it is in Size and Goodneſs.

But note, That in this Particular, the greateſt Point is carefully to chuſe good Quick-Silver; for Quick-Silver is ſometimes adulterated with Tinn, which makes it naught for this Purpoſe; it being thereby made leſs fluid, and ſo, not apt to riſe and fall with that freedom that is required in a good Baroſcope.

Now if you ſuſpect a Cheat, which you may partly gueſs at ſometimes by the Eye; for adulterated Quick-Silver looks ſomewhat dull, and is commonly cruſted over with a kind of Creamineſs; whereas

good

good Mercury looks bright and ſhining. But there be ſome ſo cunning at this knack, as to adulterate it ſo compleatly, that the naked Eye ſhall not perceive it.

Now to diſcover this cunning cheat, do thus; Take about the quantity of a Peaſe (or more) and put it into a clean Silver Spoon (an old Silver Groat, made hollow, may do as well) and ſet it over ſome hot burning Coles, in a Chafingdiſh, and in a little time the heat of the Fire will make all the Mercury fly away in Smoak; and, if when it is all flown away, it leave only a White or Yellowiſh Spot behind it, it is then fine and good; but if there be left behind

behind any kind of Subſtance that will not evaporate, or if it ſtain the Silver of a Black or Dark colour it is then bad and adulterated Quick-Silver, and no ways fit to fill a good Baroſcope.

And thus much I think ſufficient to be noted concerning all the chief parts of the Baroſcope, or Quick-Silver Weather-Glaſs: As for the true Shape and Figure of each particular, as likewiſe the way of its being made and fitted by manual Operation, theſe I have thought fit to omit, as not thinking it worth the while to deſcribe that, which every one that makes of them does already underſtand, and which if it ſhould be attem-

pted, is not well to be done by Words: All that has been done hitherto, having been done only in order to make Men more rightly to understand the true Nature and Perfection of the whole Instrument.

PART

PART II.

Directions for the right Ordering of a Baroſcope, in the ſetting of it up.

AS for the Packing up a Baroſcope, in order to its being conveyed to ſome far Diſtant Place; this I ſhall omit, as leaving that to the Workmans care: Who, when he has fixed the Inſtrument in all its Parts, and filled it with a ſufficient quantity of Quick-Silver, will alſo take care to pack it up well. All there-

fore that I ſhall now diſcourſe of, is, What is to be done in the Workmans abſence, or at a Mans own place of Reſidence, at a diſtance from him.

Having therefore firſt unpack'd every part of it with care and caution, provide to the ſetting of it up in the manner following. Firſt, ſet up the Frame, and let that be fixed faſt to the place, where 'tis deſigned to ſtand for uſe; which is done by firſt driving therein ſome Nail or Tenterhook, upon which the upper part of the Frame may be ſuſpended, driving in another Nail juſt under the Bottom, to which faſten ſome String or Ribbon, which being tyed about the Bottom-Button of the

the Frame will keep all firm and ſteddy.

How to Cleanſe and Prepare the Tube.

When the Frame is thus fixed faſt in its place, then take the Glaſs-Tube, and make the inſide of the Bore both dry and clean, for otherwiſe the Mercury will never play free therein, but hang to the Sides of the Glaſs; neither can it be perfectly cleanſed from Air or Blebs of Wind.

To do this, Take ſome Braſs or Iron Wyer, about the Size of a great Pin, and about a handful longer than the Bore of the Tube, and having made it ſtreight, file

one End of it taper and ſharp at the Point, and afterwards turn it in the faſhion of a Worm, like thoſe with which Men draw out the Charge of a Birding-Piece: This Worm, ſo formed, ſcrew into ſome clean dry Rag, and putting of it into the Bore of the Tube, draw it therein backward and forward from one End to the other, till you judge the Glaſs to be thereby made perfectly dry and clean; then clear the Tube well on the outſide with a dry Cloth, and ſet it by.

Note, That if there be the leaſt Duſt or Lint left behind in the Tube, there will a ſmall Bubble or Bleb of Air gather about that part, in ſpite of all the care and pains that ſhall be

be uſed to get it out thence; and no Art can perfectly cleanſe it from Air, till whatever offends be gotten forth from thence.

Note alſo, That for ſuch as are not capable of making a Worm, theſe may only turn back the End of a Wyer (firſt heating of it red hot in the Fire to neale and ſoften it) and make therewith an Eye, like that of a Needle, through which a Rag may be drawn, and this will ſerve almoſt as well as the former.

How to order the Quick-Silver.

If, by the foregoing Method of examining the Quick-Silver by Fire in a Silver

Spoon, you find it pure; then you have no more to do, But to take care to cleanſe it from Duſt and other Filth, which is done by ſtraining of it through ſome new piece of Fine Linnen Cloth, or (which is much better) through a piece of Fine Shammey, or thin Waſh-Leather Sheep-Skin; for this will ſuffer no Filth to paſs through it, neither will it foul the Quick-Silver with its own Subſtance, as Linen is apt to do by its own Lintineſs.

Note, That in ſtraining the Mercury, you ought not to uſe about that Work any Veſſels of Tinn or Pewter, for the Mettle of ſuch Veſſels will diſſolve in the Quick-Silver

and ſpoil it's Goodneſs; uſe therefore in this Work only Earthen or Woodden Veſſels.

How to fill the Tube, and Cleanſe it from Air.

When the Mercury is well cleanſed, then take the Tube, and reſting the cloſe end of it in ſome large Woodden or Earthen Boule or Platter, to ſave the Quick-Silver, ſhould any ſpill in the filling; then graſpe the open End of it in your Hand, between the root of the Thumb and Fore-Finger, ſomewhat low, that the hollowneſs between theſe two may ſerve inſtead of a Tunnel, then fill the Tube with Quick-Silver (by either pouring

ing

ring of it out of a Glaſs-Viol, or elſe by taking of it out of ſome other Veſſel with the clean Bole-end of a Tobaco-Pipe) till it want ſomewhat leſs than a quarter of an Inch of the Top.

Then to cleanſe it from Wind, Stop the End with your Finger, and by raiſing up the ſealed End of the Tube to ſomewhat above a level, let the Air included in that ſpace you left empty, riſe up very gently towards the Sealed End, and this will take into it ſelf all thoſe Blebs of Wind that lye in its way, and when this Bubble of Air is riſen up quite to the End, let it return again, by depreſſing a little that End, which before

was

was upmoſt, and turning the Tube a little at the ſame time, that the Bubble may take in its way other Blebs of Wind that yet may remain, and thus turning the Tube each time, you let the Bubble paſs and repaſs from one End to the other; it will in a little time cleanſe the Cylinder of Mercury from all thoſe Blebs of Wind that appear either by the Sides of the Glaſs, or are included in the body of it.

Note, That if, when you firſt fill the Tube, you leave the ſpace of half an Inch or an Inch unfilled, as ſome do, you will find it then ten times more hard to cleanſe from Air than if you leave it empty not above one quarter of an Inch ſpace. Now,

Now, when the Tube is ſo perfectly well cleanſed from Wind, that the whole Cylinder of Mercury does appear in the Glaſs, as if it were a perfect ſmooth and well poliſhed Body, and free from the leaſt Speck of Air, then turn up the open End of the Tube, and fill it quite full with Quick-Silver.

But, if, as I noted before, the leaſt Lint, Hair or Duſt imaginable, ſtick to any part of the inſide of the Tube, the beſt art of Man cannot then free it from all Air, but ſome will gather ſtill about this Matter that offends, in ſpite of all our Endeavours: In which caſe, there is no Remedy but to cleanſe the Tube anew,

anew, according to the Method before laid down.

How to put up the Tube in its Place, within the Ciſtern or Receiver.

Wipe the Ciſtern very clean, and ſet it within the Ciſtern-Box; then put therein as much Mercury as may fill it half full, if it be a Glaſs that has not yet been adjuſted; but if it has been adjuſted already, and fitted with its due quantity of Mercury, then put into the Ciſtern only that part of the Mercury that remains when the Tube is filled quite full.

Then

Then take the Tube, and ſtopping the End of it with your longeſt Finger, invert it ſo, that you may immerge the open End of it with eaſe into the Ciſtern-Mercury, in ſuch a manner, that both Glaſs and Finger may touch the Ciſtern-bottom, keeping the Tube, in the mean time, as upright as you can; then of a ſudden, take away that Finger that ſtops it, and as ſuddenly, at the very ſame inſtant of time, raiſe the Tube juſt upright; which if you perform nimbly and well, will be done before the Mercury in the Tube is all ſunk down to its loweſt Station. Now, if the Tube be raiſed almoſt upright, before the Quick-Silver

be

be all deſcended, you will not fail to ſet it up compleatly at the firſt tryal.

But in caſe any Air ſhould be admitted into the Tube in your firſt attempt, then muſt it be taken down and repurged a ſecond time, and again ſet up, according to the Method before deſcribed, and if you ſhould fail this ſecond time, then try a third for Experience will at length make you perfect, and inable you to do this Work compleat and well: But note, That a Tube is never well put up, till, according to the former Method, you have put it up ſo, as that no Wind has found admittance while the Work is doing.

When

When the Tube is well put up and fixt in the Frame, obſerve, VVhether the Ciſtern ſtand well, for ſome Ciſterns are ſo placed in the Box, That the Tube, by Reaſon of its nearneſs to the Rim, cannot be well ſurrounded by the Ciſtern-Mercury, by which means, the Air does many times find admittance that way, and ſo gets up into the Head of the Tube, and ſpoils the Glaſſes true Motion.

How to Adjuſt the Inſtrument when the Tube is ſet up.

If the Glaſs be already adjuſted to your hand, by the VVorkman that makes it (as I hinted before) then you have no

no more to do but to put all that quantity of Quick-Silver into the Ciſtern that does remain after the Tube is filled quite full; and then when the Tube is well put in it, your Baroſcope will be well adjuſted, without more ado; for when a Weather-Glaſs is once fitted with a due quantity of Quick-Silver, that ſame weight or quantity will be always ſufficient.

But, in caſe the Glaſs be not already adjuſted, or that, by miſchance, ſome part of the Quick-Silver is ſpilled and loſt, you muſt then proceed to adjuſt it according to Art, which is thus done: Take a ſtreight Rod or Rule of Wood, of the juſt length of 28 Inches,

this we call the Juſtening Gage; put one End of this Gage into the Ciſtern, and raiſe up the other End, ſo that it may juſt touch the loweſt Diviſion on the Regiſter, or that againſt which the Figure 28 ſtands, and keeping it there fixt in that Poſture, with your Finger, obſerve whether the Quick-Silver, in the Ciſtern does juſt touch the lower End of the Gage, which if it does, then is it already adjuſted well; but if it wants ſomewhat of touching the End of the Gage, then put in more Mercury, till it does ſo, but on the contrary, if there be already too much Mercury in the Ciſtern, which is known by its riſing above

above the End of the Gage or Ruler, then with the clean Head of a Tobaco-Pipe take out ſo much of it as may ſink it down juſt ſo low as the End of the Gage; and then is the Glaſs compleatly and well adjuſted.

Now the adjuſting of a Baroſcope, being nothing elſe but to raiſe the Quick-Silver to ſuch a pitch in the Ciſtern, that its Surface may be diſtant from any Figure on the Regiſter the ſame number of Inches as the ſaid Figure ſpecifies; it follows, that any other Figure will ſerve to adjuſt it by, as well as that of 28; for a Rule or Gage of 31 Inches long will do as well, if applyed to the Figure 31, as one

of 28 applyed to the Diviſion of the Figure 28; for when the Glaſs is well adjuſted, the the Quick-Silver in the Ciſtern is 31 Inches diſtant from the Figure 31, as well as 'tis 28 Inches diſtant from the Figure 28, and the ſame is to be ſuppoſed of 29 or 30.

Note here, That when a Glaſs-Tube is well fitted with a Ciſtern and well adjuſted, then if you meaſure at any time the height of the Mercurial Cylinder, you will find it always the ſame, as the Diviſion on the Regiſter notes, againſt which the Quick-Silver ſtands: But if the Ciſtern be too ſmall in Proportion then the Ciſtern-Mercury will either riſe above or fall below

the

the Pitch to which 'twas at firſt adjuſted: In which Caſes, the aforeſaid Meaſures will not be found to agree. And this may ſerve as another Inſtance of the Neceſſity of a Large Ciſtern.

How to Remove a Baroſcope to ſome ſmall Diſtance.

If it be only to remove it out of one Room into another, you need do no more, but looſen the Frame and take it from the Place to which it is faſtned, and ſo, upright in the ſame Poſture it ſtood in, let it be carefully conveyed from one Place to another by Hand; but let this be done gently, and with a careful ſtep, leſt the

QuickSilver ſurge over the Sides of the Ciſtern.

But if there be occaſion to remove a Baroſcope, by Hand, ſome larger Diſtance, as a Mile or two, then do thus: Looſen the Tube from the Frame, and gently incline the Head of it, till the Mercury fill the empty ſpace in the Head of the Tube, then nimbly ſlide your Finger under the open End that ſtands in the Ciſtern, ſtop it up cloſe, and lift the whole Tube full of Mercury, as it is, quite out of the Ciſtern; then turn the open End up, and take out from thence, as much Mercury, as will ſomewhat more than admit of a Cork, ſtop it up cloſe, then empty what Mercy remains in the

the Ciſtern, into a clean Viol-Glaſs; ſet the Ciſtern again in its Box, put therein 6 or 8 doubles of a Linen Cloth, and upon that replace the full Tube, with the ſealed End downwards and the Cork up, and having faſtned it in the Frame, take Frame and all down together, and convey it, by Hand, to the Place intended; which you may do with great Eaſe and Safety, for the Tube, though full of Mercury, will not be at all in Danger of Breaking, ſo long as 'tis kept firm in the Frame. When you are come to the Place, where 'tis to ſtand, ſet up the Frame in its Place; then take out the Tube, unſtop it, and fill it quite full; then put all

the reſt of the remaining Mercury into the Ciſtern, ſet up the Tube in it, according to the Method before deſcribed, faſten it well, and the Work is done.

Note, That by this way you will ſave all the Trouble of cleaning the Tube, ſtraining the Quick-Silver, and purging the Mercury from Air, when the Tube is filled.

How to Rectifie a Baroſcope, that by long ſtanding, does begin to move diſorderly.

It being ſo difficult for ſome perſons to purge ſome Baroſcopes from all kind of Air

Air at firſt, it follows, That the Air, which has gotten into the Tube at its firſt filling, and is not perfectly purged out from thence, will in time get free, and aſcend into the Head of the Tube, which, if it amount too much, 'twill in time greatly alter the Glaſſes Motion, by expanding and contracting it ſelf with Heat and Cold; to remedy which, Baroſcopes ought to be ſometimes rectified, and when this is needful, may be known thus: Incline the Head of the Tube from the Frame, without lifting of it from the Ciſtern, till the Head be filled by the Mercury's riſing up in it, and if you perceive a Bubble of Wind at the top, 'tis a

ſign

ſign that it wants Rectifying.

Now to do this, You need only incline the Head of the Tube till it be full of Mercy, and then ſliding your Finger nimbly under the End of it in the Ciſtern, and ſtopping it cloſe, take the Tube out, full of Mercury, and ſo expel the Bubble, by depreſſing the ſealed End ſo low, that the Bubble may mount up, and paſs out at the open End.

But ſometimes, if the Bubble be too ſmall, 'twill then remain immoveable, and will not be made to mount up, unleſs ſome more Air be let into it, which you may do by emptying out a little Mercury at the open End, and ſo ſtopping it

it with your Finger, let that Air run up and joyn with the Bubble, and then they will with eaſe return both together in one Body; which being done, fill the Tube and ſet it up again in its Place, and the Work is done.

Note, That a Baroſcope thus rectified once or twice in a Year or two Years time after 'tis firſt ſet up, will ſcarce need it any more afterwards, let it be kept at work as long as it will.

PART

PART III.

Of the Uſes of the Baroſcope, or thoſe Rules, by which we are to Judge what will be the Future State and Change of Weather.

THE chief Uſes of the Baroſcope are, To foreſhew Fair and Foul Weather, (but not Heat and Cold, theſe indeed are ſometimes judged of by conſequence, but are not at any time preciſely indicated by the Glaſſes Motion:) Now that you may be the better

ter directed, which of theſe to expect, You muſt ſtill note, the Riſing and falling of the Quick-Silver; for the Riſing of the Mercury, let it be in what part of the Glaſs ſoever, does betoken Fair Weather; and, on the contrary, its Falling down from any Place, where it laſt ſtood, does foreſhew a Foul and Wet Seaſon.

In order, therefore, to diſcern all theſe various Changes of the Mercury in the Glaſs or Tube, you muſt ſtill follow the Motion of it with the Sliding-Index, and ſet that continually, from time to time, juſt equal to the Top of the intubed Mercury, by which Means, you will have always an exact Account how the Mer-

Mercury does at any time alter; that is, Whether it does either Riſe or Fall, or how much the quantity of that Riſing and Falling is, for the Index ſtill keeping the Place, where you ſet it laſt, 'twill ſtill ſhew you which way, or how much the Mercury is removed from its laſt Height or Station.

Note, That as to the Figures on the Regiſter-Plates, their Uſe is only to denote, How High the Mercury, in the Tube, ſtands above the Surface of that in the Ciſtern, and as for the Words thereon ingraven, they are not to be noted, except the Mercury be moving from *Changeable* either Upwards or Downwards; but when

when it does ſo, then the Words are of Uſe; for if the Mercury be moving Upwards from *Changeable*, then the Weather will, for the moſt, be ſuch as the Words in that part of the Regiſter do denote. On the contrary, if the Mercury be already below *Changeable*, and does yet fall down Lower, then the Words in that lower part of the Regiſter may be noted; for the Weather, will then, for the moſt part, fall out accordingly.

But, if the Quick-Silver does Riſe when 'tis below *Changeable*, or fall when 'tis already above it, then the Words ſignifie nothing; for if Riſing in any Part ſignifies Fair, and Falling in any Part does denote Foul,

Foul, then it follows, That if it fall from *Setled Fair* to *Fair*, it may Rain, notwithſtanding the Quick-Silver does ſtill ſtand as High as *Fair*. The like may be ſaid if it Riſe from *Much Rain* to *Rain*, for its Riſing does now betoken Fair Weather, notwithſtanding 'tis ſtill as Low as the Word *Rain*: Therefore take this for a general Rule, That if the Mercury move Upwards from *Changeable*, or fall from *Changeable* Downwards, then will the Weather be for moſt part ſuch as theſe Upper or Lower Words denote; but if it either Riſe towards *Changeable*, or fall downwards to it, when 'tis already above it, then the Words ſignifie nothing.

If

If Wet and Rainy Weather come presently upon the Mercury's Falling, and the Mercury does at that time fall but a little, then expect not much Wet at that time, for the Rain will not then hold long; but if the Quick-Silver falls very much in a little Time, or if, when it begins to Sink, it continues to do so for two or three Days together, before the Rains come, then expect very much Wet Weather after it.

On the contrary, If Fair Weather follows immediately upon the Mercury's Rising, and the Rising be also but a little, then expect not much Fair Weather at that time; but if it Rise very much on a sudden, or if, when it begins to Rise,

it continues to do ſo for two or three Days together, before the Fair Weather comes, and the Rains ceaſe, then expect much Fair VVeather to follow.

But in all theſe foregoing Caſes, the VVind muſt well be noted; for unleſs you do that you may chance to be ſometimes miſtaken, for tho' the former Rules are for the moſt true and certain, and ſeldom fail, yet ſometimes they are found ſo to do; but when this does chance to happen, you will, for the moſt part, find it to do ſo at ſuch times as the VVind ſits in ſuch Quarters, whoſe temper is contrary in Nature to that Weather which the Glaſs Predicts; for

if

if the Mercury fall, which is a Sign of VVet, yet if the VVind, at the ſame time does blow from the Eaſt or North, it may ſtill continue Fair, becauſe, theſe for the moſt part are dry Winds, and ſeldom produce Rain, for Reaſons hereafter given. On the contrary, If the Quick-Silver Riſe, which ſignifies Fair, yet, if the VVind be then Southerly, it may chance to Rain for all that; for Southerly VVinds are generally Moiſt, and many times bring in groſs Vapours that are too heavy to be ſuſpended by any weight of Air which they produce.

But if the Mercury fall, and the VVind be Southerly, 'tis a thouſand to one but Rain

will follow; and on the contrary, If the Quick-Silver Riſe, and the Wind be Eaſterly, 'tis a thouſand to one, but 'twill then be Fair Weather, for in theſe Circumſtances, I have ſeldom or never, found the Glaſs to fail; let the Wind, therefore, be noted well in every Caſe.

If the Mercury be very high in the Summer-Time, when 'tis Hot Weather, and does of a ſudden fall down a conſiderable Diſtance, then expect Thunder, or great and ſudden Storms of Rain.

If the Mercury does Riſe very High in the Winter-time, *viz.* to *Setled Fair*, or above it, and the Wind be then North or Eaſt, it does certainly

ly preſage much Froſt, and you may be certain alſo, That the ſame will continue as long as the Mercury does ſtand thus High. But when the Mercury in a ſetled Froſt Sinks down ſuddenly five or ſix Diviſions on the Regiſter, 'tis then a certain ſign of a Thaw, and the Froſt will then undoubtedly break up and be gone.

If, in a Froſt, when the Mercury has ſtood High for a time, it does of a ſudden Riſe yet Higher, then you may certainly expect Snow to follow.

If the Mercury Riſe and fall but a little at a time, and it be very Unſetled its Motion, it then argues the Weather to be Unconſtant, and that it will not continue long in one ſtate.

Note, That falling, when the Mercury is already below *Changeable*, is a ſign of more Wet than falling above it: And on the contrary, Riſing, when the Mercury is already above *Changeable*, denotes more certain dryneſs, than Riſing does below it.

As for Heat and Cold, that is gathered from this Glaſs by conſequence only, for when the Mercury ſtands High in Summer, as it denotes Fair Weather or very Dry, ſo by conſequence it argues a Hot Seaſon. So likewiſe, if it be extreme High in the Winter, it argues much Cold, for height of Mercury, being at this Seaſon a certain ſign of Froſt, it fol-

follows, that Cold will undoubtedly attend it.

Note, That the Mercury is ever loweſt of all in extreme High and Strong VVinds, but yet it does no way predict Winds before hand, as it does moſt other Weather; for the Mercury falls thus extreme low, at the very time only of the Winds blowing. Note alſo, That as ſoon as theſe High Winds ceaſe to blow, the Mercury then generally Riſes very faſt of a ſudden; but ſuch Riſings that do immediately follow Storms of Wind are no certain Signs of Fair Weather, unleſs it Riſe to above *Changeable.*

Note alſo, That the greateſt Heights of Mercury are always found upon Eaſterly or North Eaſterly Winds, and and that the Faireſt Weather and Dryeſt Times are, in this Engliſh Nation, always accompanied with theſe kinds of Winds.

PART

PART IV.

Giving an account of the moſt probable Reaſons of the various Motions of the Baroſcope, and the Effects that follow.

The Reaſon in general of the Mercury's Suſpenſion in the Tube.

'TIs now generally agreed upon, on all ſides, That tis the preſſure of the Air upon the Stagnant Mercury in the Ciſtern, that does buoy up that in

in the Tube to its uſual Hight; but in regard 'tis hard for ſome to conceive the manner how, I ſhall endeavour to demonſtrate it in a Cyphon-Tube, which, for this purpoſe is much more proper than a Common Weather-Glaſs.

Take then a Glaſs Tube or Pipe, about four Foot long, ſeal it cloſe at one End, and let about a Foot of the other End be turned up, Cyphon-like, in the Form of a Fiſh-Hook, fill the longeſt Leg of this Tube with Quick-Silver, cleanſe it from Air, and then raiſe it upright, upon which you ſhall find that the Quick-Silver will Sink down in the Longeſt Leg, and Riſe up in the

the Short One, till the two Mercurial Surfaces are equally Diſtant with that of the Tube and Ciſtern in the Common Weather-Glaſs.

Now, the Reaſon of its being thus Suſpended in the Longeſt Leg does proceed from the Airs preſſure at the open End of the Short One; for ſuppoſe that a Cylinder or Pillar of Air, of the bigneſs of the Bore of the Tube, be extended ſo high, as to equal in weight a Cylinder of Quick-Silver 29 or 30 Inches High, which ſome conclude to be near 45 Miles; it follows, That the Weight of this Pillar of Air preſſing in at the open End of the Tube, will ballance or ſuſpend that Mercu-

ry

ry that is juſt equal to it ſelf in Weight; and from hence it is, that as the Air does grow either Heavier or Lighter, ſo will the Quick-Silver in the Tube either Riſe or Fall.

Now what is here ſaid of the Cyphon-Tube, is to be underſtood of the Common-Weather-Glaſs, for in that 'tis the Preſſure of the Air on the Ciſtern-Mercury that buoys up the Quick-Silver in the Glaſs-Tube, and according as this Weight of Air does alter, ſo does the Mercurial Cylinder either Riſe or Fall, and from the Weight of Airs being the Cauſe of its Motion, it comes to paſs, That Baroſcopes which ſtand in High Mountains never Riſe ſo High as

as thoſe that ſtand in lower places, which may, in great part, ſuffice to prove, That 'tis the Airs preſſure that does ſuſpend the Quick-Silver, as aforeſaid.

This laſt particular has been experimented by divers Perſons, but eſpecially by Dr. *Power*, who in the Year 1653, found that at the bottom of *Hallifax-Hill*, the Mercury ſtood at the pitch of 29 Inches high, but conveying it from thence to the top of the Hill, he found it to fall there near half an Inch lower. The like is reported of Dr. *Paſcal*, who upon the top of a Mountain 500 Perches high, near *Claramont*, found the Mercury to ſtand

Powers Exp. Philoſ. p. 104.

ſtand three Inches lower than it did at the bottom. The like Remark has been made by Phil. Tranſ. N. 11. p. 182. Eſq; *Boyle*, who tells us, *That a Baroſcope ſtanding at* Stanton St. Johns, 4 *Miles diſtant from* Oxford, *on a Hill, was uſually between* 2 *and* 3 *eights of an Inch higher than one at* Oxford *that ſtood lower near the* Thame-ſide. All which can proceed from no other Reaſon, but from the various gravity of the ſuperincumbent Air; for a longer, and ſo conſequently a more weighty Colume of Air does preſs upon the Ciſtern-Mercury in Low Countries than upon the tops of Mountains, which being nearer the top of the Atmoſphære, has by conſequence a leſs weight

weight of Air to preſs upon it: So that from hence we may conclude, That as it is the weight of Air that ſuſpends the Mercury in general, ſo it is the differing degrees of that weight that makes it to Riſe and Fall.

By what means the Air becomes ſometimes Thinner and Lighter, and ſometimes more Thick and Heavy, than uſual, in this Nation.

Theſe, according to Mr. *Ed. Halley*'s Opinion, in the *Philoſ. Tranſ.* of May 25. 86. are ſuppoſed to ariſe from thoſe contrary Winds that uſually blow in theſe Northern Climates; for if two contrary Winds blow

t wards

towards the place where the Baroſcope ſtands, the Air is thereby increaſed both in Height and Weight, and ſo made capable of ſupporting a greater Pillar of Mercury; as for inſtance, if it blow a Weſterly Wind in *Ireland*, and an Eaſterly Wind in ſome parts of *Holland* and *Flanders*, this would crowd in abundance of Air over *England*, and heap it up to a great Height, and by conſequence, make the Weather-Glaſs Riſe much; on the contrary, two Winds blowing from the place where the Weather-Glaſs ſtands, will exhauſt the Air, and by conſequence make it more Thin and Light there, and that will cauſe the Quick-Silver to ſink; as for exam-

Example, if it ſhould blow a Northern Wind in *France*, and a Southern Wind in *Scotland*, or one of theſe in *Holland* and the other in *Ireland*, it muſt needs then follow, that the Air impendent over *England* would thereby be much leſſen'd and exhauſted, and by conſequence made more light, and leſs able to ſuſpend ſo great a quantity of Mercury.

Why Wet and Rainy Weather follows the ſinking of the Mercury.

The reaſon of this is, becauſe the Air being then grown Thinner and Lighter, is unable to ſupport thoſe Vapors that before were ſuſpended in it, for they being now too Heavy to float in a Lighter Medium, do deſcend, and in their

fall incorporate themſelves with others, till at laſt, by many additions they become Drops of Rain.

Why Fair Weather follows the Mercury's Riſing.

The Reaſon is, Becauſe the Air being now grown more Heavy and Thick, does with eaſe ſupport thoſe Particles of Water which before it could not ſuſpend, for all Bodies ſwim in that Medium that is ſpecifically heavier than themſelves; as is made out in that Common Experiment of making our Engliſh Metheglin, where the Rule is, To make it ſo ſtrong of the Honey, that it may make an Egg ſwim, and riſe up above the Liquor the bredth of a Groat. Now this

Egg

Egg in plain Water ſinks to the bottom, but when the Water is made ſo ſtrong of the Honey, that the quantity of an Egg of it ſhall be heavier than the Egg it ſelf, then the Egg ſwims. Even ſo here, when the Air is ſo crouded together by contrary Winds blowing towards the ſame place, as to be made more heavy than before, then thoſe particles of Water, which before fell down by reaſon of the Airs Lightneſs, will not do ſo when the Medium is thus made more heavy than themſelves are.

Why the Mercury always ſtands higheſt upon Eaſterly or North Eaſterly Winds.

This happens by reaſon of the Winds blowing almoſt always South or South-weſt in

the *Great Atlantick Ocean*, on this ſide the 35 Degree of North Latitude; by which means it comes to paſs, that when an Eaſt or North Eaſterly Wind blows, 'tis ſure to be checkt by a contrary Blaſt when it reaches the Ocean; whence it muſt needs follow that the Air will be ſtrongly heaped up over this Iſland, and conſequently the Mercury muſt ſtand High whenſoever theſe Winds do blow, except they be very high and Turbulent; in which caſe, the Mercury may yet fall, for a Reaſon to be given hereafter. The following Reaſon may be alſo in ſome part the cauſe of this Height of Mercury in North and North Eaſt Winds. *Why*

Why in great Froſts the Mercury generally ſtands very High.

This proceeds partly from the foregoing Reaſon, but chiefly from the Coldneſs of thoſe Winds that blow in Froſty Weather, which generally are North or Eaſterly Winds, whoſe coldneſs does ſtrangly contract the Air, and by conſequence, thicken it, as is plain in the unſealed Thermoſcope, in whoſe Ball the Air does manifeſtly ſhrink and ſwell with Cold and Heat. Now when the Air in one part of the World is contracted and ſhrunk up into leſs room than before, the Air in other parts will then flow in to ſupply the uſual height of the Atmoſphere; and that being again

condenſed, it follows, that the Air muſt needs then be very weighty, and ſo buoy up the Quick-Silver very high.

Why Riſing yet Higher in Froſty Weather, when the Quick-Silver is already very High, foreſhews Snow.

The Reaſon is, Becauſe Snow, when formed above, is by its extreme Coldneſs capable of condenſing the Air more powerfully than the moſt extreme Cold, without it can, and by conſequence, makes it more thick and weighty; ſo that when the Quick-Silver has ſtood high for a time, and then does yet riſe more high of a ſudden, we may conclude that there is Snow in the Air, which by its more intenſe coldneſs does thus ſuddenly contract it

and

and more abundently increaſe its weight.

Why the Mercury falls loweſt in great Winds.

The reaſon of this may be, For that theſe great Storms force out violently that Air that Stagnats in thoſe places in which they blow, and that with ſo great a violence that the adjacent Air cannot come in faſt enough to ſupply the evacuation made by ſo great a current of Wind: Beſides which 'tis probable, That the Horizontal motion of the Wind being ſo violent, may take off much of the perpendicular Preſſure of the Air, and that may ſuffer the Quick-Silver to ſink down ſo very low.

The Reaſon why it Rains very ſeldom in great Winds, tho the Quick-Silver be low.

This is becauſe, though the Air be then too light to ſupport almoſt any kind of Vapour, yet the agitation made by the Winds does prevent their falling. Brick-Duſt or Sand in a Viol of Water, ſinks when the Liquor is at reſt, but when agitated by ſhaking, 'twill then ſwim ſo long, as that Motion continues; ſo here the agitation of the Air by ſtrong Winds, keeps thoſe Vapours from deſcending, which otherwiſe would fall, by reaſon of the Airs lightneſs, and this is the reaſon, why, when there is Rain in the Air, it generally holds up till theſe Winds ceaſe, and then it falls down.

Why

Why Southern Winds ſometimes produce Rain, though the Quick-Silver Riſe: and Northern or Eaſtern Fair; though the Quick-Silver fall.

To underſtand this, conſider, That Watry Particles are rarified by the diverſity of the Celeſtial Influence into Bodies of divers dimenſions, and the more intenſe that Heat is that rarifies, by ſo much the larger will thoſe Aquaous Particles be. This is plain in wet Linen preſented before a large Fire, where you ſhall perceive the watry Particles to be raiſed from thence ſo groſs as to be perceived by the naked Eye, whereas, had it been hung up to dry in a leſs intenſe Heat, it would have become dry by a more minute and inſenſible Evapo-

Evaporation. Now 'tis plain that what Rain comes to us from the South, does ariſe in parts more hot than ours, and by conſequence are rarifications of the largeſt ſize, and ſuch as are too heavy to be ſuſpended by that weight of Air that is uſually produc'd by Winds from that quarter.

Whereas on the contrary, Thoſe Vapors that are raiſed in colder Countries, and brought to us by Northern or Eaſterly Winds, are much more fine and light, and by conſequence are uncapable of falling down in our Climate, though the Air ſhould grow lighter than uſual, for though this lightneſs may be remarkable, yet it may be ſtill heavier

than

than thoſe lighter Vapors are that float in it.

Why it ſhould be a Sign of much Fair Weather to follow, when it rains ſometime after the Quick Silver Riſes before the Fair Weather comes.

In Metrology there are undoubtedly ſome concurring Cauſes that may be very difficult for Human Wit to Fathom; all that we can do then, at moſt is to offer the moſt probable Reaſons, as to this particular; know then, that as rarification of Water is the effect chiefly of the Celeſtial Influences and Aſpects, ſo theſe Aſpects are in ſome part the cauſe of ſuſpending more ſtrongly what they have raiſed by their ſecret Influences. Now if it rain for 2 or 3 Days,

after

after the Quick-Silver riſes, before Fair Weather comes, it argues that the Celeſtial Influences do not concur with other Natural Cauſes at that Time, and by conſequence, when theſe ceaſe to ſupport thoſe Vapors that are already rarified and raiſed, it argues their Power to be too weak and unable to attract and rarifie freſh Matter for Rain; ſo that when the Air is thus wholly freed from what Rain does already float in it, it will undoubtedly be followed with a large Seaſon of Fair Weather, till the Celeſtial Influences do again become ſtrong by their proper Aſpects to attract freſh Matter for Foul Weather.

Note

Note that what has been ſaid in this laſt Part, does accord only with our Engliſh Climate, and we dare not warrant them to hold good in other Countries, where the Circumſtances are vaſtly different from this of ours.

Some other neceſſary Obſervations.

Dr. *Wallis* Obſerves, in *Philoſophical Tranſactions* N. 10. p. 170. That his Baroſcope being made with a larger Tube than Eſq; *Boyles*, did not ſometimes riſe ſo high as the Eſquires by near a quarter of an Inch. I judge the Reaſon to be, for that the Doctors Tube was too big in Proportion for his Ciſtern; and therefore for Reaſons given, where I treat of

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the Ciſtern, muſt needs move thus Irregular.

Dr. *Beale*, *Philoſophical Tranſactions*, Numb. 9. p. 157. Obſerved a Baroſcope to aſcend ſomewhat higher in the cold Mornings and Evenings than at Mid-day; the Reaſon did undoubtedly proceed from Air gotten into the Head of the Tube, which by expanding and contracting with Heat and Cold was the Cauſe of this Motion,

'Tis obſerved, *Philoſophical Tranſactions*, Numb. 55. p. 116. That a Baroſcope did uſually riſe in the Heat of the day, till after three or four Years ſtanding, and then it uſually ſunk down with the Heat, as before it roſe; the cauſe did

did undoubtedly proceed from the Quick-Silvers being not well purged from Air: and that Air in the Body of the Mercury being expanded by the Heat, did cauſe the Quick-Silver to ſwell, and by conſequence riſe higher; whereas, when by time, it had got free into the Head of the Glaſs, by expanding there, the contrary effect did follow.

If you emerge a well filled Tube into a Ciſtern of Mercury, and there haſtily draw out the Tube perpendicularly quite out of the Quick-Silver, the Mercury in the Tube will riſe up to the top, with ſuch a violence as will indanger the breaking

breaking of the Head of the Glaſs. This I note, as a Caution to thoſe that have occaſion to take down a Glaſs, leſt they ſuffer dammage by ſo doing, as ſome have done.

FINIS.
